PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-223144

(43)Date of publication of application : 11.08.2000

(51)Int.Cl. H01M 8/06
// H01M 8/10

(21)Application number : 11-018317

(22)Date of filing : 27.01.1999

(71)Applicant : AISIN SEIKI CO LTD

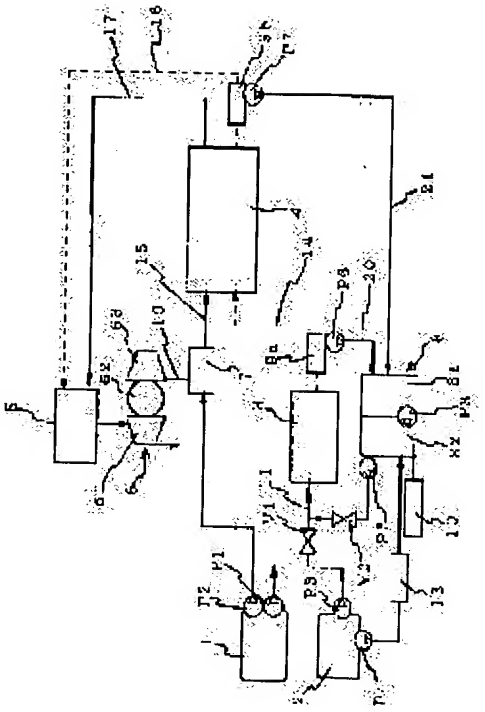
(72)Inventor : KURITA KENJI

(54) FUEL CELL SYSTEM AND ITS CONTROLLING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To collect and recycle water without degrading the performance of fuel cells.

SOLUTION: This fuel cell system is equipped with a reformer 3 for reforming a reforming material made of a hydrocarbon fuel and water into a fuel gas having hydrogen as a main constituent, and a fuel cell stack 4 for generating electricity by using the fuel gas and an oxidant gas. In this controlling method of the fuel cell system, water collecting means 9a, 9b for collecting condensed water are provided on at least one of a fuel-gas pipeline 14 for connecting the reformer 3 to the fuel cell stack 4 and a fuel-gas off-gas pipeline 16 for exhausting off gas of the fuel gas not used in the fuel cell stack, and water collected by the water collecting means 9a, 9b is recycled as reforming material.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or

application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In a fuel cell system equipped with the fuel cell stack which generates the refining raw material which consists of a hydrocarbon system fuel and water using the refining machine which reforms hydrogen to the fuel gas used as a principal component, and said fuel gas and oxidizer gas A water recovery means to collect the water condensed at least to one side of the fuel gas off-gas duct which discharges the fuel gas off-gas which was not used by the fuel gas duct which connects said fuel cell stack with said refining machine, and said fuel cell stack is established. The fuel cell system characterized by reusing the water collected by this water recovery means as said refining raw material.
[Claim 2] The fuel cell system according to claim 1 characterized by reusing the recycled water which established a recycled water storage means to connect with said water recovery means through a recycled water duct, and was stored in this recycled water storage means as said refining raw material.
[Claim 3] Said recycled water storage means consists of two stores dept.s, and the 1st stores dept. connects with said recycled water duct. It has a rate detection means. the 2nd stores dept. -- the mixing ratio of water and a hydrocarbon system fuel -- the water and the hydrocarbon system fuel which detects a rate -- a mixing ratio -- Said refining machine is connected with said 2nd stores dept. through a pump and a closing motion means. The fuel cell system according to claim 2 characterized by establishing a migration means for said 2nd stores dept. to be connected with a hydrocarbon system fuel storage means through a pump, and to move water to said 2nd stores dept. from said 1st stores dept.
[Claim 4] the water and the hydrocarbon system fuel prepared in the 2nd stores dept. of said recycled-water storage means -- a mixing ratio -- the signal detected by the rate detection means -- being based -- the water in said 2nd stores dept., and the mixing ratio of a hydrocarbon system fuel -- the control approach of the fuel cell system characterized by to supply a hydrocarbon system fuel to said 2nd stores dept. from said hydrocarbon system fuel storage means so that a rate may turn into the target ratio.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a fuel cell system and its control approach.
[0002]
[Description of the Prior Art] Although the cure against exhaust gas of an automobile is important and the electric vehicle is used as one of the cure of the in order to reduce atmospheric contamination as much as possible, it has not resulted in spread on problems, such as a charging equipment and mileage.
[0003] It is concluded that the automobile which a fuel cell is generated by the reverse reaction of electrolysis using hydrogen and oxygen, does not have excretions other than water, is observed as a clean power plant, and used said fuel cell is most promising clean automobile. In order that a solid-state polyelectrolyte mold fuel cell may operate at low temperature also in said fuel cell, it is the most promising as an object for automobiles.
[0004] The fuel cell which pinched the layered product to which a solid-state polyelectrolyte mold fuel cell system comes to carry out the laminating of the cell cel of the electrolyte which generally sandwiched the solid-state polyelectrolyte film with two electrodes (a fuel electrode and oxidizer pole), and a large number which pinched the zygote of an electrode with the separator in the pressure plate, It consists of a fuel gas supply means to supply fuel gas to said fuel electrode side, an oxidizer gas supply means to supply oxidizer gas to said oxidizer pole side and various gas piping, and a control unit that controls them.
[0005] In said fuel electrode, when the hydrogen in fuel gas contacts a fuel electrode catalyst, the following reaction arises.
[0006] 2H2 -> 4H+ +4 e-H+ moves in the inside of an electrolyte, reaches an oxidizer pole catalyst, reacts with the oxygen in air, and becomes water.
[0007] 4H+ +4e- +O2 -> In order that water may also move with migration of H+ from a 2H2O fuel electrode, moisture is included as a steam and supplied to the fuel gas supplied to a fuel electrode. When an electrolyte is the solid-state polyelectrolyte film, also in order to maintain the electrolytic engine performance, the moisture more than a complement is included in the above-mentioned reaction as a steam, and fuel gas is supplied, and it is necessary to include moisture as a steam and to supply it also to oxidizer gas.
[0008] The generation water generated by the electrode reaction of the humidification water which contains in fuel gas and oxidizer gas and is supplied to a fuel cell, and a fuel cell is contained in the fuel gas off-gas and oxidizer gas off-gas which are discharged from a fuel cell, and is discharged.
[0009] In the solid-state polyelectrolyte mold fuel cell system, the refining machine which generally reforms a hydrocarbon system fuel and water and manufactures fuel gas is formed. As a hydrocarbon system fuel, gaseous fuel, such as liquid fuel, such as a methanol, ethanol, and a gasoline, and natural gas, LPG, can be considered. Generally, a methanol is used for the goodness of cost, handling nature, and a refining property.
[0010] Since it excels in the portability of a fuel, and supplement nature, promising ** of the fuel cell

system by which said refining machine was formed is carried out as fuel cell systems for mount, such as an automobile. The water for the water supplied to said refining machine and said humidification water is required of this fuel cell system, and it is important to use water efficiently. The automobile with which water cannot be especially replaced during operation is an important thing in the fuel cell system for mount. As a conventional technique, to JP,9-17438,A, the water in the fuel gas off-gas which is the blowdown component discharged from a fuel cell, and oxidizer gas off-gas is collected, and the fuel cell system reused as a refining raw material and humidification water is indicated.

[0011]

[Problem(s) to be Solved by the Invention] However, although the conventional technique condenses the water in the fuel gas off-gas discharged from a fuel cell, and oxidizer gas off-gas, stores it in the one reservoir section and is reused as humidification water of a refining raw material and fuel gas, and oxidizer gas, since the impurity is contained in the aforementioned water of condensation, if it reuses as it is, it will lead to the generation-of-electrical-energy degradation of a fuel cell.

[0012] That is, it is contained in the fuel gas off-gas discharged from a fuel cell while the hydrocarbon system fuel has been unmodified very only. Therefore, if the refining raw material is contained in the water of condensation very only from fuel gas off-gas and this is used as humidification water of fuel gas, the concentration of the hydrocarbon system fuel contained in fuel gas will go up gradually, and it will have an adverse effect on the electrode catalyst of a fuel cell.

[0013] Moreover, when it is used as humidification water of oxidizer gas and there is the same problem as fuel gas, since the hydrocarbon system fuel originally is not contained in oxidizer gas, and the measures against poisoning are not taken against the electrode catalyst of the oxidizer pole of a fuel cell, it has a bigger adverse effect than a fuel electrode on this electrode catalyst. If the aforementioned water of condensation is used as a refining raw material, since the ratio of the hydrocarbon system fuel and water of a refining raw material will change, there is a possibility of the refining engine performance worsening and reducing the generation-of-electrical-energy engine performance of a fuel cell.

[0014] Furthermore, the water of condensation is stored in the reservoir section through a vapor-liquid-separation means. However, although it is very small, there is a possibility that gas may mix. When this water of condensation is used as humidification water, in fuel gas, the hydrogen in fuel gas is oxidized by the oxygen of the mixed oxidizer gas, and there is a possibility of reducing hydrogen concentration and reducing the generation-of-electrical-energy engine performance of a fuel cell. The same is said of oxidizer gas. If the aforementioned water of condensation is used as a refining raw material, since the ratio of a refining raw material and oxygen will change, there is a possibility of the refining engine performance worsening and reducing the generation-of-electrical-energy engine performance of a fuel cell.

[0015] Although it is possible to form the equipment which removes an impurity from the water of condensation as a means to solve these problems, since a hydrocarbon system fuel and water have compatibility, it will become large-sized to remove a hydrocarbon system fuel from water, even if it can do by being difficult.

[0016] This invention is what solved the above-mentioned technical problem, and it offers the fuel cell system which can collect and reuse water, without reducing the engine performance of a fuel cell.

[0017]

[Means for Solving the Problem] In order to solve the above-mentioned technical technical problem, the technical means (the 1st technical means are called hereafter.) provided in claim 1 of this invention In a fuel cell system equipped with the fuel cell stack which generates the refining raw material which consists of a hydrocarbon system fuel and water using the refining machine which reforms hydrogen to the fuel gas used as a principal component, and said fuel gas and oxidizer gas A water recovery means to collect the water condensed at least to one side of the fuel gas off-gas duct which discharges the fuel gas off-gas which was not used by the fuel gas duct which connects said fuel cell stack with said refining machine, and said fuel cell stack is established. It is the fuel cell system characterized by reusing the water collected by this water recovery means as said refining raw material.

[0018] The effectiveness by the 1st technical means of the above is as follows.

[0019] That is, since the recycled water from the fuel gas off-gas with which a hydrocarbon system fuel is contained is reused as a hydrocarbon system fuel and a refining raw material which consists of water, the need of removing the hydrocarbon system fuel which is the impurity of recycled water can also collect and reuse water nothing, without reducing the engine performance of a fuel cell.
[0020] In order to solve the above-mentioned technical technical problem, the technical means (the 2nd technical means are called hereafter.) provided in claim 2 of this invention are fuel cell systems according to claim 1 characterized by reusing the recycled water which established a recycled water storage means to connect with said water recovery means through a recycled water duct, and was stored in this recycled water storage means as said refining raw material.
[0021] The effectiveness by the 2nd technical means of the above is as follows.
[0022] That is, since it is temporarily stored in a recycled water storage means, when reusing as a refining raw material, adjusting as a refining raw material component is easy.
[0023] In order to solve the above-mentioned technical technical problem, the technical means (the 3rd technical means are called hereafter.) provided in claim 3 of this invention Said recycled water storage means consists of two stores dept.s, and the 1st stores dept. connects with said recycled water duct. It has a rate detection means. the 2nd stores dept. -- the mixing ratio of water and a hydrocarbon system fuel -- the water and the hydrocarbon system fuel which detects a rate -- a mixing ratio -- Said refining machine and said 2nd stores dept. are connected through a pump and a closing motion means. It is the fuel cell system according to claim 2 characterized by establishing a migration means for said 2nd stores dept. to be connected with a hydrocarbon system fuel storage means through a pump, and to move water to said 2nd stores dept. from said 1st stores dept.
[0024] The effectiveness by the 3rd technical means of the above is as follows.
[0025] That is, since the 1st stores dept. can share the quality governing and role of a refining raw material of recycled water with acceptance of the recycled water from a water recovery means, and the 2nd stores dept., the quality governing as a refining raw material is easy for it.
[0026] In order to solve the above-mentioned technical technical problem, the technical means (the 4th technical means are called hereafter.) provided in claim 4 of this invention It is based on the signal detected by the rate detection means. the water and the hydrocarbon system fuel prepared in the 2nd stores dept. of said recycled water storage means -- a mixing ratio -- It is the control approach of the fuel cell system characterized by supplying a hydrocarbon system fuel to said 2nd stores dept. from said hydrocarbon system fuel storage means so that the mixed ratio of the water in said 2nd stores dept. and a hydrocarbon system fuel may turn into the target ratio.
[0027] The effectiveness by the 4th technical means of the above is as follows.
[0028] namely, water and a hydrocarbon system fuel -- a mixing ratio -- the quality governing as a refining raw material can be made into accuracy by using a rate detection means.
[0029]
[Embodiment of the Invention] Hereafter, the example of this invention is explained based on a drawing.

[0030] Drawing 1 is fuel cell system charts for mount, such as an automobile of the example of this invention. In this fuel cell system, the reformed gas which reforms the refining raw material which consists of a methanol which is a hydrocarbon system fuel, and water with a refining vessel, and uses hydrogen as a principal component is manufactured, and it is used as fuel gas. Moreover, air is used as oxidizer gas.
[0031] This fuel cell system consists of drains 9a and 9b which are a water tank 1, the methanol tank 2, the refining machine 3, a fuel cell 4, the burner 5 that is a combustion means to burn fuel gas off-gas by making oxidizing agent gas off-gas into a combustion improver, the turbo assistant compressor 6 which is an oxidizing agent gas supply means, a humidifier 7, and a water recovery means, and a recycled water tank 8 which is a recycled water storage means.
[0032] said recycled water tank 8 consists of two stores dept.s which consist of the 1st stores dept. 81 and the 2nd stores dept. 82 -- having -- said 2nd stores dept. 82 -- water and a hydrocarbon system fuel -- a mixing ratio -- it has the S/C sensor 10 which is a rate detection means.

[0033] Said water tank 1 is a tank which has stored the water which is a refining raw material. Said water tank 1 was connected with the shut bulb V1 through the pump P1, and is connected with said humidifier 7 through a pump P2. Said methanol tank 2 was connected with the shut bulb V1 through the pump P3, and is connected with the 2nd stores dept. 82 through a pump P4.
[0034] Said shut bulb V1 is connected with said refining machine 3 through the refining raw material duct 11. The flowmeter 13 is formed on the duct which connects said pump P4 and 2nd stores dept. 82. In addition, although the water as a refining raw material and the water as an ingredient for humidification are using the same water tank 1 in this example, another water tank may be used.
[0035] Said 2nd stores dept. 82 has connected with said refining raw material duct 11 which sends a refining raw material to the refining machine 3 through a pump P5 and the shut bulb V2. Said refining machine 3 is equipment which manufactures the fuel gas which uses hydrogen as a principal component using a methanol and water, and is connected with said fuel cell 4 through the fuel gas duct 14. Drain 9a which collects the water of condensation is prepared in this fuel gas duct 14.
[0036] Said turbo assistant compressor 6 consists of a turbine 61, a motor 62, and a compressor 63. This compressor 63 is equipment which pressurizes the air which is oxidizer gas and is supplied to the oxidizer pole of said fuel cell 4, and is connected with said humidifier 7 through the air pipe way 19. This humidifier 7 is connected with said fuel cell 4 through the air pipe way 15.
[0037] The fuel gas off-gas which was not used with said fuel cell 4 is supplied to said burner 5 through the fuel gas off-gas duct 16. Moreover, the air off-gas which was not used with said fuel cell 4 is supplied to said burner 5 through the air off-gas duct 17. Drain 9b which collects the condensed water is prepared in said fuel gas off-gas duct 16. Said burner 5 is connected with the turbine 61 of said turbo assistant compressor 6 through the exhaust gas pipe way 18.
[0038] Said drain 9a has connected with said 1st stores dept. 81 through a pump P6 and the recycled water duct 20. Said drain 9b is also connected with said 1st stores dept. 81 through a pump P7 and the recycled water duct 21.
[0039] If this fuel cell system is started, said shut bulb V1 will be opened, control of flow will be carried out with a pump P1, control of flow of the water will be carried out with a pump P3 from a water tank 1, and a methanol will be sent to the refining machine 3 from the methanol tank 2. Refining of the refining raw material which consists of the sent methanol and water is carried out to the fuel gas which uses hydrogen as a principal component with said refining vessel 3.
[0040] As an approach of reforming to said fuel gas, a steam reforming process and partial reforming are known. This steam reforming process is the approach of generating the fuel gas which the methanol and water which were made to evaporate are contacted for a copper-zinc system catalyst, reforms at the following reaction, and uses hydrogen as a principal component.
[0041]
$CH_3OH + H_2O \rightarrow 3H_2$ The $+CO_2$ aforementioned partial reforming is the approach of generating said fuel gas which mixes air in the methanol and water which were made to evaporate, is contacted for an oxidation catalyst and a copper-zinc system catalyst, reforms at the following reaction, and uses hydrogen as a principal component.
[0042] $CH_3OH + 0.13O_2 + 0.47N_2 + 0.75H_2O \rightarrow 2.75H_2 + CO_2 + 0.47N_2$ -- also in which reaction, since water also moves with migration of H^+ from a fuel electrode, in order to include a steam in fuel gas, much water is supplied to said refining machine 4 from the complement at the above-mentioned reaction. When an electrolyte is the solid-state polyelectrolyte film, in order to maintain the electrolytic engine performance, much more moisture is included in fuel gas, and it supplies, and it is necessary to include moisture also in air and to supply.
[0043] The fuel gas manufactured with said refining vessel 3 is supplied to the fuel electrode side of a fuel cell through the fuel gas duct 14. Some water contained in said fuel gas condenses in said fuel gas duct 14. The produced water of condensation is collected by drain 9a, and is sent and stored in the 1st stores dept. 81 through a pump P6 and the recycled water duct 20.
[0044] On the other hand, the motor 62 of the turbo assistant compressor 6 starts, and air is pressurized by the compressor 63. The air pressurized by said compressor 63 is sent to a humidifier 7 through the air

pipe way 19. In said humidifier 7, said air contains as a steam the water which control of flow was carried out with the pump P2, and was sent from the water tank 1, and is supplied to the oxidizer pole side of said fuel cell 4 through the air pipe way 15.
[0045] The fuel gas supplied to the fuel electrode and the air supplied to the oxidizer pole are generated by the electrode reaction shown previously. At this time, the generation water generated by said electrode reaction contains in air off-gas, and is discharged by the air off-gas duct 17. The water supplied with said humidifier 7 and the water which moved to the oxidizer pole together with H+ from the fuel electrode are also contained in this air off-gas.
[0046] In said fuel cell 4, the hydrogen in fuel gas is not used 100%, and is about 80% of utilization factor. The fuel gas off-gas which was not used with said fuel cell 4 is sent to a burner 5 through the fuel gas off-gas duct 16. The remainder of the water which moved to the oxidizer pole is contained in this fuel gas off-gas as a steam. The air discharged by said air off-gas duct 17 is also sent to said burner 5.
[0047] Some steams contained in said fuel gas off-gas condense in said fuel gas off-gas duct 16. The produced water of condensation is collected by drain 9b, and is sent and stored in the 1st stores dept. 81 through a pump P7 and the recycled water duct 21.
[0048] In addition, in this example, although the drain is established in the fuel gas off-gas duct 16 as a water recovery means, a condenser may be formed and water may be collected positively. More water is recoverable if a condenser is used.
[0049] By said burner 5, the hydrogen in fuel gas off-gas burns considering the oxygen in air off-gas as a combustion improver. The combustion gas of said combustion burner 5 is sent to the turbine 61 of the turbo assistant compressor 6, and is used as power which rotates this turbine 61 and rotates a compressor 63. If this turbine 61 begins to work, the electric power supply to a motor 62 will be fallen or stopped. Thereby, the power used by said turbo assistant compressor 6 can be saved.
[0050] Drawing 2 is flow chart drawing explaining control of water recovery and reuse. Water recovery which collects the water of condensation to the 1st stores dept. 81 is controlled by step S101, and it progresses to step S102. At this step S102, recycled water starting for which the water of the 1st stores dept. 81 is moved to the 2nd stores dept. 82 is performed, and it progresses to step S103. At this step S103, the water moved to the 2nd stores dept. 82 is adjusted to a refining raw material component, reuse supplied to the refining machine 3 is performed, and it progresses to step S104. At this step 104, if a fuel cell system judges whether it is under [operation] ********, and is operating [be / it], and said steps S101-S103 were repeated and it has stopped, this control will also be ended.
[0051] Drawing 3 is flow chart drawing explaining control of water recovery of the above. step S105 -- the 1st stores dept. -- water level -- predetermined -- it judges whether it is lower than water level h1, and if low, it will progress to step S106. said 1st stores dept. -- water level -- predetermined -- water level -- if it is more than h1, step S105 is repeated. At step S106, pumps P6 and P7 are started, the water of condensation of Drains 9a and 9b is collected to the 1st stores dept. 81, respectively, and it progresses to step S107.
[0052] At this step S107, the 1st stores dept., at least predetermined water judges whether it is more than h1, and if water level is above, it progresses to step S108. said 1st stores dept. -- water level -- predetermined -- if lower than water level h1, step S107 will be repeated. Said pumps P6 and P7 are suspended, and it stops collecting the water of condensation to the 1st stores dept. by step 108, and returns to step S105. This water recovery routine is repeated during operation of a fuel cell system.
[0053] Drawing 4 is flow chart drawing explaining control of recycled water migration of the above. At step S109, the 1st stores dept., at least predetermined water judges whether it is more than h1, and if water level is above, it progresses to step S110. said 1st stores dept. -- water level -- predetermined -- while it is lower than water level h1, step S109 is repeated. At said step S110, it judges whether the pump P5 has stopped, and if it has stopped, it will progress to step S111. If said pump P5 is operating, said step S110 will be repeated.
[0054] said step S111 -- the 2nd stores dept. -- water level -- predetermined -- it judges whether it is lower than water level h2, and if low, it will progress to step S112. said 1st stores dept. -- water level -- predetermined -- water level -- if it is more than h2, step S111 is repeated. At said step S112, a pump P8

is started, the recycled water of the 1st stores dept. 81 is moved to the 2nd stores dept. 82, and it progresses to step S113.
[0055] At this step S113, the 2nd stores dept., at least predetermined water judges whether it is more than h2, and if water level is above, it progresses to step S114. said 2nd stores dept. -- water level -- predetermined -- while it is lower than water level h2, step S113 is repeated. At said step S114, said pump P8 is suspended, migration of recycled water is stopped, and it returns to step S109. This recycled water migration routine is repeated during operation of a fuel cell system.
[0056] Drawing 5 is flow chart drawing explaining control of the above of reuse. At step S115, the 2nd stores dept., at least predetermined water judges whether it is more than h2, and if water level is above, it progresses to step S116. said 2nd stores dept. -- water level -- predetermined -- while it is lower than water level h2, step S115 is repeated. At step S116, it judges whether the pump P8 has stopped, and if it has stopped, it will progress to step S117. If said pump P8 is operating, said step S116 will be repeated.
[0057] At said step S117, a pump P4 is started, control of flow of the methanol of the methanol tank 2 is carried out, and it progresses to delivery and step S118 at the 2nd stores dept. 82. Although the methanol is contained, since there is little water sent to said 2nd stores dept. 82 as a refining raw material, it adds a methanol in order to use as a refining raw material component the liquid which supplies a methanol and is stored in said 2nd stores dept. 82.
[0058] At said step S118, the mixed ratio (water / methanol ratio is called.) of the water of the liquid stored by the S/C sensor formed in said 2nd stores dept. 82 and a hydrocarbon system fuel is measured, and water / methanol ratio judges whether it is more than ratio alpha1 predetermined. If said water / methanol ratio are more than ratio alpha1 predetermined, it progresses to step S119, said pump P4 is suspended, and if fewer than a ratio alpha 1, step S118 will be repeated.
[0059] Control of flow is carried out with a pump P4, and a methanol is supplied to said 2nd stores dept. 82 from the methanol tank 2 so that said water / methanol ratio may become a ratio required for the refining machine 3. Since it is necessary to control this flow rate to accuracy, it is controlling said pump P4, it measuring a flow rate with a flow meter 13, and applying feedback. This becomes the refining raw material of the water / methanol ratio alpha 1 of the liquid of said 2nd stores dept. 82.
[0060] It progresses to step S120 from said step S119. At this step S120, closing is started for the shut bulb V1, and an aperture and a pump P5 are started for the shut bulb V2. This pump P5 carries out control of flow of the refining raw material of the 2nd stores dept. 82, and supplies it to the refining machine 3 through the refining raw material duct 11. Thereby, it changes from a water tank 1 and the methanol tank 2 to the refining raw material of water / methanol ratio alpha 1 with which the refining raw material currently supplied to said refining machine 3 is stored in the 2nd stores dept. 82.
[0061] then, the step S121 -- the 2nd stores dept. -- water level -- predetermined -- it judges whether it is lower than water level h3, and if low, it will progress to step S122. said 2nd stores dept. -- water level -- predetermined -- water level -- if it is more than h3, step S121 is repeated. said 2nd stores dept. -- water level -- predetermined -- water level -- a refining raw material is supplied to the refining machine 3 from said 2nd stores dept. between beyond h3.
[0062] At said step S122, the shut bulb V1 is suspended for an aperture, and closing and a pump P5 are suspended for the shut bulb V2. Thereby, the refining raw material supplied to the refining machine 3 is changed to the water and the methanol of a water tank 1 and the methanol tank 2. This reuse routine is repeated during operation of a fuel cell system.
[0063] In this fuel cell system, since it is used as a refining raw material of the refining machine which collects the water in fuel gas off-gas, and manufactures fuel gas, even if some refining raw materials are contained in the water to collect, it is not necessary to remove it and can reuse.
[0064]
[Effect of the Invention] As mentioned above, this invention is set to a fuel cell system equipped with the fuel cell stack which generates the refining raw material which consists of a hydrocarbon system fuel and water using the refining machine which reforms hydrogen to the fuel gas used as a principal component, and said fuel gas and oxidizer gas. A water recovery means to collect the water condensed at least to one side of the fuel gas off-gas duct which discharges the fuel gas off-gas which was not used

by the fuel gas duct which connects said fuel cell stack with said refining machine, and said fuel cell stack is established. Since it is the fuel cell system characterized by reusing the water collected by this water recovery means as said refining raw material, and its control approach, water can be collected and reused, without reducing the engine performance of a fuel cell.

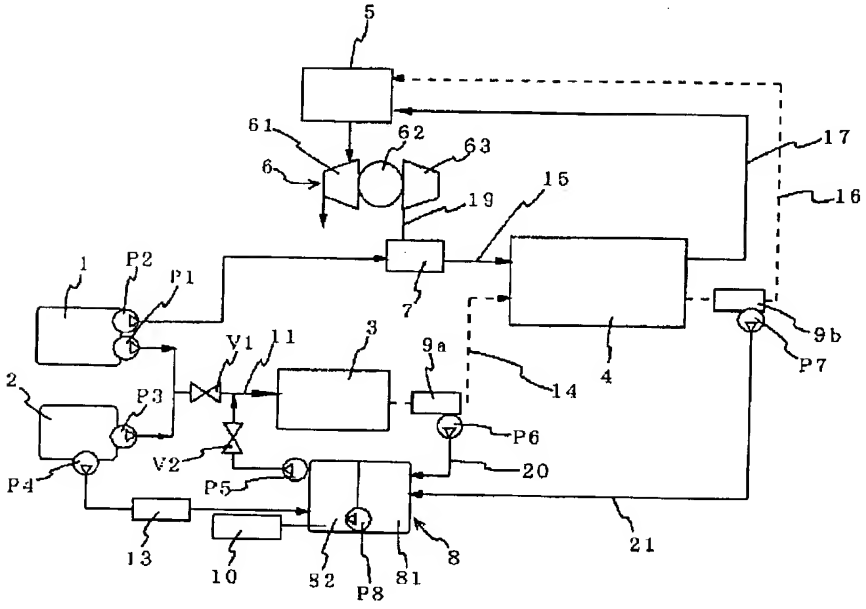
[Translation done.]

* NOTICES *

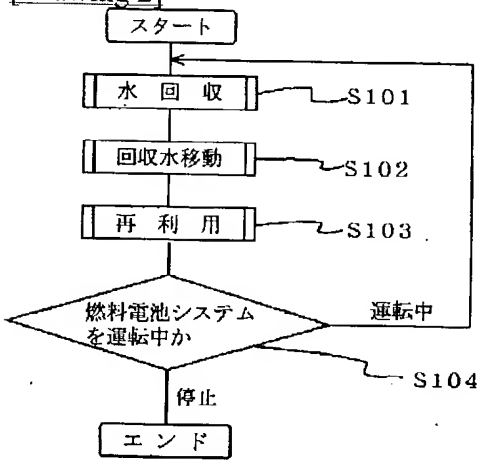
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

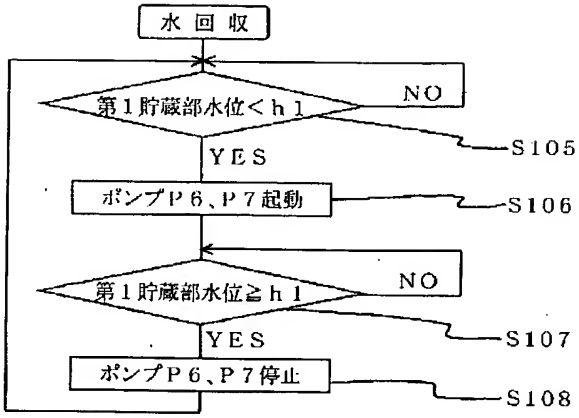
[Drawing 1]



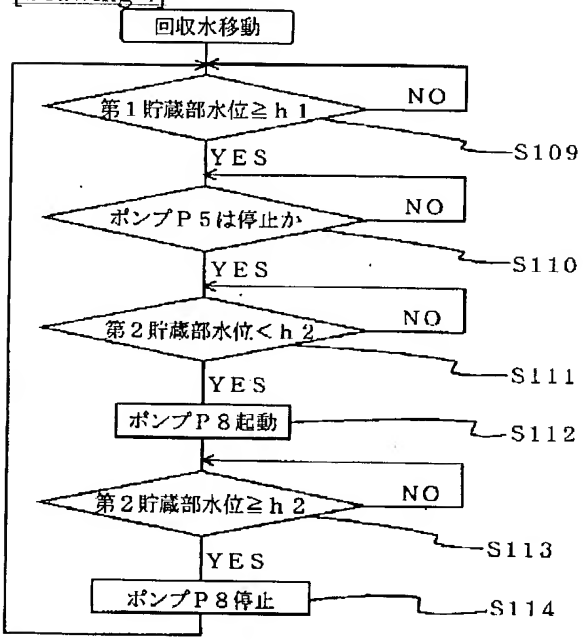
[Drawing 2]



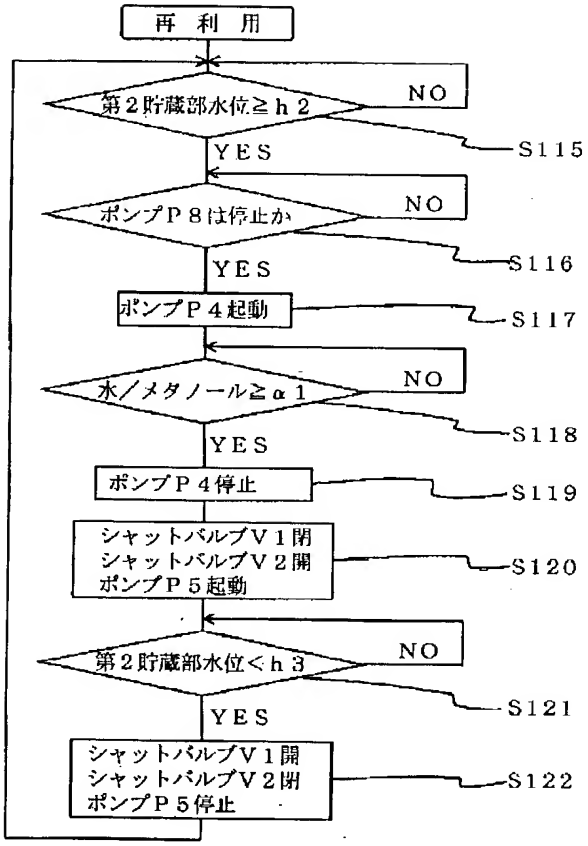
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Fuel cell system charts for mount, such as an automobile of the example of this invention
[Drawing 2] Flow chart drawing explaining control of water recovery and reuse
[Drawing 3] Flow chart drawing explaining control of water recovery
[Drawing 4] Flow chart drawing explaining control of recycled water migration
[Drawing 5] Flow chart drawing explaining control of reuse
[Description of Notations]
1 -- Water tank
2 -- Methanol tank (hydrocarbon system fuel storage means)
3 -- Refining machine
4 -- Fuel cell stack
8 -- Recycled water tank (recycled water storage means)
9a, 9b -- Drain (water recovery means)
10 -- S/C sensor (water and a hydrocarbon system fuel a mixing ratio rate detection means)
14 -- Fuel gas duct
16 -- Fuel gas off-gas duct
20 21 -- Recycled water duct
81 -- The 1st stores dept.
82 -- The 1st stores dept.
P4, P5 -- Pump
P8 -- Pump (migration means)
V1, V2 -- Shut bulb (closing motion means)

[Translation done.]